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The coastal rove beetles (Coleoptera, Staphylinidae) of Atlantic Canada: a survey and new records

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Abstract

The coastline inhabiting rove beetles (Coleoptera: Staphylinidae) of Atlantic Canada are surveyed. Thirty-three species have now been recorded in Atlantic Canada including 26 in New Brunswick, 15 in Newfoundland, 31 in Nova Scotia, and 13 on Prince Edward Island. *Oligota parva* Kraatz, *Acrotona avia* (Casey), *Strigota ambigua* (Erichson), and *Myrmecopora vaga* (LeConte) are all newly recorded in Canada, and *Bledius mandibularis* Erichson is newly recorded in Atlantic Canada. We retain *A. avia* as a species distinct from *A. subpygmaea* Bernhauer and designate a lectotype for *A. avia*. Ten new provincial records are reported, one from New Brunswick, six from Nova Scotia, and three from Prince Edward Island. Four functional groups, halobiont (obligate), halophile (facultative), haloxene (tolerant), and incidental coastal species, are distinguished and the fauna is examined from the perspective of the particular coastline habitats and microhabitats they have been found to inhabit.

Fourteen of the 33 staphylinids are introduced, Palearctic species, and eight of these have been associated with historical dry ballast shipping to the region from Great Britain. A trophic analysis indicates that some species are phytophagous algae feeders, while others are either generalist predators, or predators specializing on particular taxonomic or functional groups of invertebrates. Finally, some attention is devoted to discussing the diminished areas of coastline environments such as coastal marshes, and the various kinds of environmental disturbances and degradations they have experienced. These indicate the potential vulnerability of such coastal habitats and consequently of the communities of beetles that inhabit them.

Keywords

Staphylinidae, coastal environments, ecology, biodiversity, systematics, Atlantic Canada

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Introduction

While beetles are species rich and are ubiquitous in terrestrial and freshwater environments, only a relatively small number are found in marine situations. Amongst non-staphylinid beetles, Doyen (1976) listed 11 families (Carabidae, Hydrophilidae, Hydraenidae, Heteroceridae, Limnichidae, Melyridae, Salpingidae, Tenebrionidae, Rhizophagidae, Chrysomelidae, and Curculionidae) some species of which are obligate inhabitants of marine environments. Jeon and Ahn (2007) reported that 442 species of Staphylinidae in 102 genera and 7 subfamilies are known to be confined to seashore habitats, 0.93% of the circa 47, 744 described species of Staphylinidae (Herman 2001), and very close to the approximately 1% of rove beetles that Moore and Legner (1976) said were known to be confined to seashore habitats. Moore and Legner (1976: 521) wrote that, "Since habitat records are not known for the majority of staphylinids, it is not surprising if we are unaware of the marine habitat of some species".

In Europe there has been a considerable degree of attention to coastal Staphylinidae. Hammond (2000) published a thorough review of the British fauna based on extensive data sets. Fifty-eight species of halobiont, halophile, and halotolerant staphylinids are reported, with maps of each species in the British Isles, and 32 additional species occurring in coastal habitats, but not restricted to such environments, are also discussed for a total fauna of 90 species. A considerable degree of attention has also been paid to the coastal Staphylinidae of the Pacific coast of North America (Moore 1975, Moore and Legner 1976), however, comparatively little attention has been paid to the North American Atlantic coastal fauna.

There has been some recent attention in the Maritime Provinces to seashore/coastline inhabiting Staphylinidae with the result that species such as *Atheta novaescotiae* and *Atheta acadiensis* have been newly described from the region, and species such as *Brachygluta abdominalis* have been newly recorded in Canada from such environments. Other characteristic coastline staphylinids such as *Aleochara litoralis*, *Bledius* spp., and *Creophilus maxillosus* have been noted in combination with a variety of other Coleoptera that characteristically inhabit coast-line, beach-drift, and sand dune ecosystems (Herman 1972, 1976; Klimaszewski 1984; Majka and Ogden 2006; Klimaszewski et al. 2006; Klimaszewski and Majka 2007; Majka and Klimaszewski 2008).

Despite these studies of particular species or genera, relatively little research has been done on the Coleoptera of coastal environments in Atlantic Canada in general, and on the Staphylinidae in particular. In the present paper we survey coastline-inhabiting Staphylinidae of Atlantic Canada, newly recording a number of species in New Brunswick, Nova Scotia, Prince Edward Island, Atlantic Canada, and Canada as a whole.

Methods and conventions

A number of collections containing representatives of Staphylinidae collected in Atlantic Canada were examined and records of coastline-inhabiting species were compiled. Codens (following Evenhuis 2007) of collections referred to in this study are:

ACNS Agriculture and Agri-food Canada, Kentville, Nova Scotia, Canada
CBU Cape Breton University, Sydney, Nova Scotia, Canada
CGMC Christopher G. Majka collection, Halifax, Nova Scotia, Canada
CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
DHWC David H. Webster collection, Kentville, Nova Scotia, Canada
JCC Joyce Cook collection, North Augusta, Ontario, Canada
JOC Jeff Ogden collection, Truro, Nova Scotia, Canada
NSMC Nova Scotia Museum, Halifax, Nova Scotia, Canada
NSNR Nova Scotia Department of Natural Resources, Shubenacadie, Nova Scotia, Canada
RWC Reginald P. Webster collection, Charters Settlement, New Brunswick, Canada
STFX Saint Francis Xavier University, Antigonish, Nova Scotia, Canada
UMNB Université de Moncton, Moncton, New Brunswick, Canada
UPEI University of Prince Edward Island, Charlottetown, Prince Edward Island, Canada
USNM United States National Museum, Washington, District of Columbia, USA

The species included in the survey were both those that had been collected in marine environments in the region, as well as species that have been noted in the literature as occurring in such habitats. For the purposes of this treatment Atlantic Canada has been taken to be comprised of the provinces of New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island, as well the Iles de la Madeleine in the Gulf of St. Lawrence (which are a part of the province of Québec) and the French territories of Saint-Pierre et Miquelon which lie off of the south coast of Newfoundland. The distribution of all species is either shown in Figures 12-15, or else sources of published distribution maps are indicated.

Key to species

The following key to the species of coastal Staphylinidae of Atlantic Canada is provided. It is modified and adapted from Newton et al. (2000), Downie and Arnett (1996), Smetana (1995), and Herman (1972, 1976, 1986) together with additional material.

1 Antennae inserted anterior to a line drawn between the anterior margins of the eyes 2
– Antennae inserted posterior to a line drawn between the anterior margins of the eyes 24
2(1) Head with deep conical foveae on the vertex (Pselaphinae)..... ..... *Brachygluta abdominalis*
– Head without deep conical foveae on the vertex..... 3

3(2) Head with a pair of ocelli between the posterior margins of the eyes (Omalinae) ..... *Micralymma marinum*

– Head without ocelli 4

4(3) Abdomen with seven visible abdominal sterna (Oxytelinae) 5

– Abdomen with six visible abdominal sterna..... 9

5(4) Labrum entire medially..... 6

– Labrum divided medially 8

6(5) Basal third of lateral pronotal margin markedly sinuate..... 7

– Basal third of lateral pronotal margin straight or evenly curved to base ..... *Bledius basalis*

7(6) Ratio of elytral length/pronotal length (at midline) 1.58-1.76; elytra brownish-black with sub-scutellar yellowish spot ..... *Bledius opaculus*

– Ratio of elytral length/pronotal length (at midline) 1.33-1.50; elytra yellowish with black sutural and basal stripes..... *Bledius neglectus*

8(5) Epipleural ridge of elytron present only on apex..... *Bledius mandibularis*

– Epipleural ridge of elytron present along entire length ..... *Bledius politus*

9(4) Head constricted behind eyes so as to form a distinct neck visible from above 10

– Head not constricted behind eyes, no neck visible (Tachyporinae) ..... *Sepedophilus marshami*

10(9) Inter-segmental membranes of abdomen with a distinct rectangular "brick wall" pattern; pronotum with large post-coxal process (Paederinae) ..... *Ochthephilum fracticorne*

– Inter-segmental membranes of abdomen various (rounded or triangular patterns, or pattern indistinct) but never with a "brick wall" pattern; pronotum without postcoxal process (Staphylininae) 11

11(10) Strongly sclerotized plate (single, or divided medially into two contiguous sclerites) in front of prosternum present (Xantholinini) 12

– Strongly sclerotized plate in front of prosternum absent..... 13

12(11) Metatibia with apical and sub-apical ctenidia, the latter interrupted medially but extended proximally along outer margin of metatibia ..... *Gyrohypnus angustatus*

– Metatibia with apical ctenidium only..... *Xantholinus linearis*

13(11) Disc of pronotum either densely punctate or glabrous; ligula notched (Staphylinina) 14

– Disc of prontotum generally with two rows of punctures medially; ligula entire, rounded or slightly sinuate apically (Philonthina) 15

14(13) Disc of pronotum glabrous; white pubescence on the anterior angles of the pronotum, across the medial part of the elytra, and on abdominal tergites four and five ..... *Creophilus maxillosus villosus*

– Disc of pronotum densely punctate; lacking white pubescence ..... *Tasgius ater*

15(13) Largest lateral macrosetal puncture of pronotum separated from the lateral margin by at most little more than the width of the puncture 16
– Largest lateral macrosetal puncture of pronotum separated from the lateral margin by at least three times the width of the puncture .....*Cafius bistriatus*
16(15) Protarsus with basal four tarsomeres more or less dilated, each tarsus bearing modified pale setae on ventral surface in addition to regular marginal setae..... 17
– Protarsus with basal four tarsomeres not dilated, each tarsus bearing only regular marginal setae..... *Gabrius astutoides*
17(16) Dorsal rows on pronotum each with four punctures 18
– Dorsal rows on pronotum each with five punctures or more 23
18(17) Lateral margins of pronotum at least slightly sinuate posteriorly in front of basal margin..... 19
– Lateral margins of pronotum evenly arcuate to parallel posteriorly in front of basal margin..... 21
19(18) Posterior basal line on visible abdominal tergites two and three acutely extended posteriad at middle.....*Philonthus politus*
– Posterior basal line on visible abdominal tergites two and three not acutely extended posteriad at middle 20
20(19) Small species (6.8-7.8 mm); eyes large; pronotum iridescent.....
.....*Philonthus umbratilis* (in part)
– Large species (8.7 – 13.6 mm); eyes moderately large, pronotum not iridescent..... *Philonthus furvus*
21(17) First antennal article bicolored, dark with underside yellow .....
.....*Philonthus cognatus*
– First antennal article unicolored, dark..... 22
22(21) Surface of pronotum iridescent .....*Philonthus umbratilis* (in part)
– Surface of pronotum not iridescent..... *Philonthus carbonarius*
23(17) Dorsal rows on pronotum each with five punctures.....*Philonthus varians*
– Dorsal rows on pronotum each with six punctures.....*Philonthus couleensis*
24(1) Hind coxae separated, small; eyes bulbous covering side of head (Steninae)
.....*Stenus erythropus*
– Hind coxae contiguous, large; eyes various but not bulbous and covering side of head (Aleocharinae) 25
25(24) Tarsal formula 5-5-5; maxillary and labial palps each with an apical pseudosegment (Aleocharini) .....*Aleochara litoralis*
Tarsal formula otherwise; maxillary and labial palps without apical pseudosegments 26
26(25) Tarsal formula 4-4-4 (Hypocyphtini) ..... *Oligota parva*
– Tarsal formula 4-5-5 27
27 (26) Pronotum broadest subapically, narrowed behind to a base not more than 3/4 of the maximal width of the pronotum (Falagriini) 28

– Pronotal base more than 3/4 of the maximal width of the pronotum (Athetini) 29

28(27) Scutellum bicarinate ..... *Falagria dissecta*

– Scutellum not bicarinate ..... *Myrmecopora vaga*

29(27) Pronotal hypomeron not at all visible in lateral view 30

Pronotal hypomeron narrowly to moderately visible in lateral view 32

30(29) Body robust, narrowly oval; antennal articles 4-6 slightly elongate and 7-10 quadrate to slightly transverse ..... *Mocyta fungi*

– Body fine, subparallel; antennal articles 4-6 quadrate to transverse and 7-10 moderately to strongly transverse 31

31(30) Body glossy; abdominal tergites sparsely to moderately densely punctuate; tergite eight of both sexes with antecostal suture (basal line) subparallel to the base of the disc ..... *Acrotona avia*

– Body moderately glossy, appearing somewhat opaque and velvety; abdominal tergites densely punctuate; tergite eight of both sexes with antecostal suture (basal line) arcuate and joining base of the disc before reaching its margin and then reaching downwards toward the apical margin of disc ..... *Strigota ambigua*

32(29) Pronotum with setae in midline directed anteriorly; pronotum with asperate punctation ..... *Atheta (Datomicra) acadiensis*

– Pronotum with all setae directed posteriorly or posterolaterally; pronotum without asperate punctation 33

33(32) Body opaque; pronotum at mid-length almost as broad as elytra at base; abdomen subparallel and distinctly narrower than elytra along its entire length; apical margin of male tergite 8 with 2 small lateral dents and shallow medial emargination pointed medially ..... *Atheta novaescotiae*

– Body glossy; pronotum at mid-length distinctly narrower than elytra at base; abdomen with sides arcuate, broadest in mid-length and about as broad as elytra; apical margin of male tergite 8 truncate and without any dents ..... *Atheta (Thinobaena) vestita*

Results

The following species of Staphylinidae associated with coastal habitats have been recorded from Atlantic Canada. There are two main categories of species; a) those that are regular members of coastal environments (halobionts, halophiles, and haloxenes); and b) incidental species that exhibit no specific coastal associations, but are generally attracted to decomposing situations, and hence are incidentally found in coastal environments.

Omaliinae

Micralymma marinum (Ström, 1785)

NOVA SCOTIA: Guysborough Co.: Tor Bay, 6.V.1996, R.F. Lauff, intertidal zone, (1, NSMC).

This species is newly recorded in Nova Scotia and its distribution in Atlantic Canada is shown in Fig. 12. It is a widely distributed Holarctic species found in intertidal habitats throughout Europe, Russia, Iceland, Greenland, Atlantic Canada, and New England in the USA (Larsson and Gígja 1959; Thayer 1985; Böcher 1988; Campbell and Davies 1991; Downie and Arnett 1996; Herman 2001). Böcher (1988, 34) wrote, "*M. marinum* is a true marine insect, presumably spending its entire life cycle in the tidal zone, where it is regularly submerged at high tide. Adults and larvae are generally found together, on vertical parts or the underside of stones and rocks …". Adults and larvae are predaceous, feeding on Collembola such as *Anurida maritima* (Guérin-Méneville, 1836), mites, and Thysanura although it is possible that larvae are, at least in part, also phytophagous feeding on algae (Thayer 1985; Böcher 1988; Hammond 2000).

Pselaphinae

Brachygluta abdominalis (Aubé, 1833)

Brachygluta abdominalis was reported in New Brunswick and Nova Scotia by Majka and Ogden (2006). Its distribution in Atlantic Canada and Maine is shown in Majka and Ogden (2006). The species is found in leaf litter in salt marshes and sand dune areas and in beach drift at the upper margin of the intertidal zone (Majka and Ogden 2006). Species of *Brachygluta* are specialist predators of mites (Hammond 2000).

Tachyporinae

Sepedophilus marshami (Stephens, 1832)

This species was recorded from Nova Scotia by Campbell (1976) and from New Brunswick by Majka and Klimaszewski (2008). Its distribution in North America is shown in Campbell (1976) and in the Maritime Provinces by Majka and Klimaszewski (2008). Davies (1979) found this adventive Palearctic species in seaweed beach wrack in St. Andrews (NB), and Campbell (1976) reported it from "shore refuse". It has also been found in many forested, open, and fresh-water habitats and probably only occurs sporadically in coastline environments. Hammond (2000) includes it as a generalist species regularly reported from saline and intertidal situations in Great Britain.

Aleocharinae

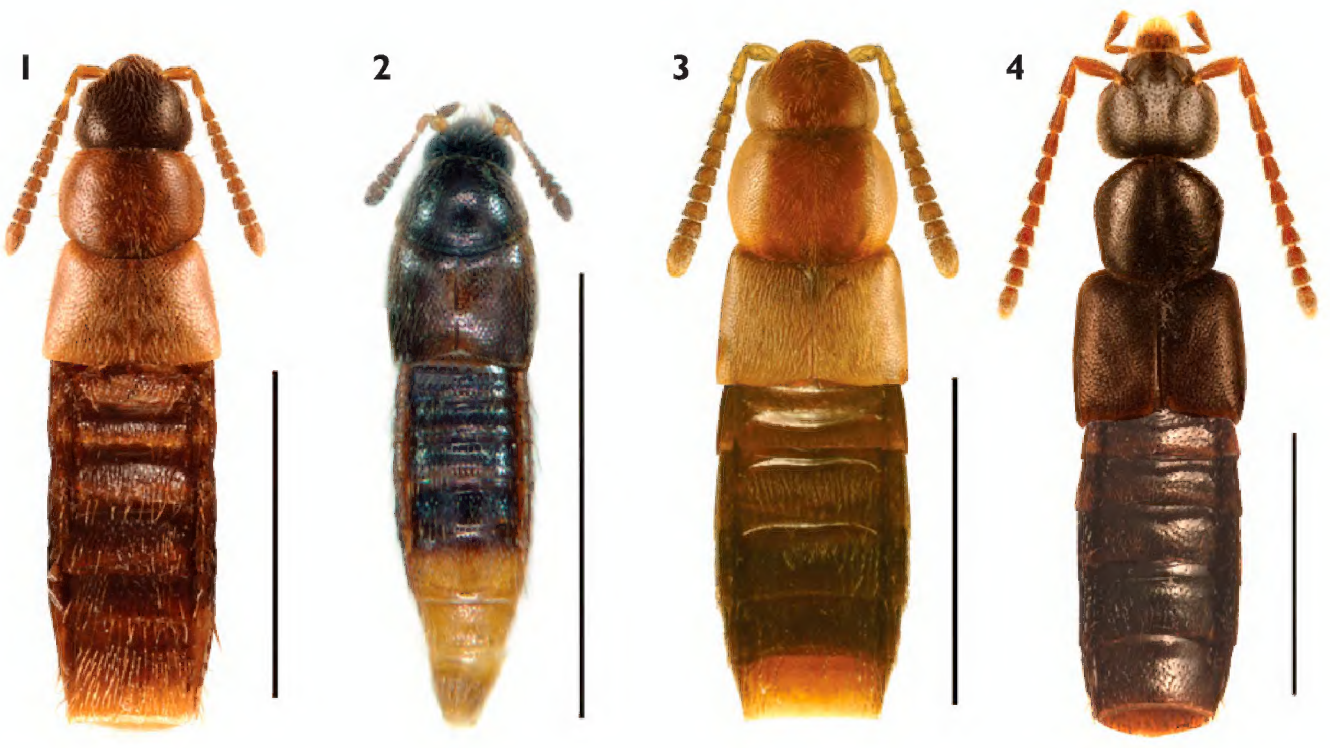
Aleochara (Emplenota) litoralis (Mäklin, 1853)

NEW BRUNSWICK: Albert Co.: Mary's Point, 23.VIII.2003, C.G. Majka, beach drift below sand dunes, (3, CGMC). **NOVA SCOTIA: Cape Breton Co.:** Scatarie Island, N.W. Cove, 8.VIII.2005, 11.VIII.2005, K.R. Aikens, & A. MacDonald, ocean beach, under wrack, (2, CBU); **Richmond Co.:** Framboise, Morrison, 15.VI.1997, D.B. McCorquodale, beach, (3, CBU); **Halifax Co.:** Point Pleasant Park, 23.VII.2002, C.G. Majka, under decaying seaweed on sand beach, (3, CGMC).

Aleochara litoralis was reported from New Brunswick, Newfoundland, and Nova Scotia by Klimaszewski (1984). Additional records are given above. Its distribution in the region of Atlantic Canada is shown in Fig. 12. The adults and larvae are found in decaying seaweed and debris on ocean beaches (Klimaszewski 1984). *Aleochara* adults are predators of larvae and eggs of cyclorrhaphous Diptera and ectoparasitoids of the pupae as larvae (Klimaszewski 1984). The specific hosts of *A. litoralis* have not previously been documented, however, C.G. Majka has collected *Coelopa frigida* (Fabricius, 1805) (Diptera: Coelopidae), a common and widespread Holarctic fly, in Point Pleasant Park in association with *A. litoralis*. Adults, larvae, and pupae of this fly were very numerous in the decomposing seaweed and are presumably the prey species utilized by *A. litoralis*.

Oligota parva Kraatz, 1858

PRINCE EDWARD ISLAND: Kings Co.: Launching, 26.VIII.2003, C.G. Majka, ocean beach: under coastline drift at the top of the littoral zone, (4, CGMC).



Figs 1-4. Dorsal habitus: Fig. 1, *Acrotona avia*; Fig. 2, *Oligota parva*; Fig. 3, *Strigota ambigua*; Fig. 4, *Myrmecopora vaga*.

Oligota parva (Fig. 2) is newly recorded in Canada (Fig. 12). It has been previously recorded from California, Massachusetts, Missouri, and Texas (Moore and Legner 1975). It has been introduced to the western Palearctic and northern Africa and is now widespread there (Horion 1967; Smetana 2004). It is found in compost, on dung, in fermenting materials, in old hay and grass, and in other decomposing situations (Horion 1967). The ecology of *Oligota* species are not well known, however, at least some species prey on mites (Frank et al. 1992). While *O. parva* has not previously been reported as a beach drift species, all the specimens collected on Prince Edward Island were found in this habitat. One European species, *Oligota pusillima* Gravenhorst, 1806 has been recorded in decaying seaweed (Fowler 1888; Moore and Legner 1975).

Other characteristic beach drift species collected together with *O. parva* at Launching (PEI), include *Atheta acadiensis*, *Strigota ambigua* (see below) [Staphylinidae], *Hypocaccus fraternus* (Say, 1825) [Histeridae], *Monotoma producta* LeConte, 1855 [Monotomidae], and *Blapstinus metallicus* (Fabricius, 1801) [Tenebrionidae].

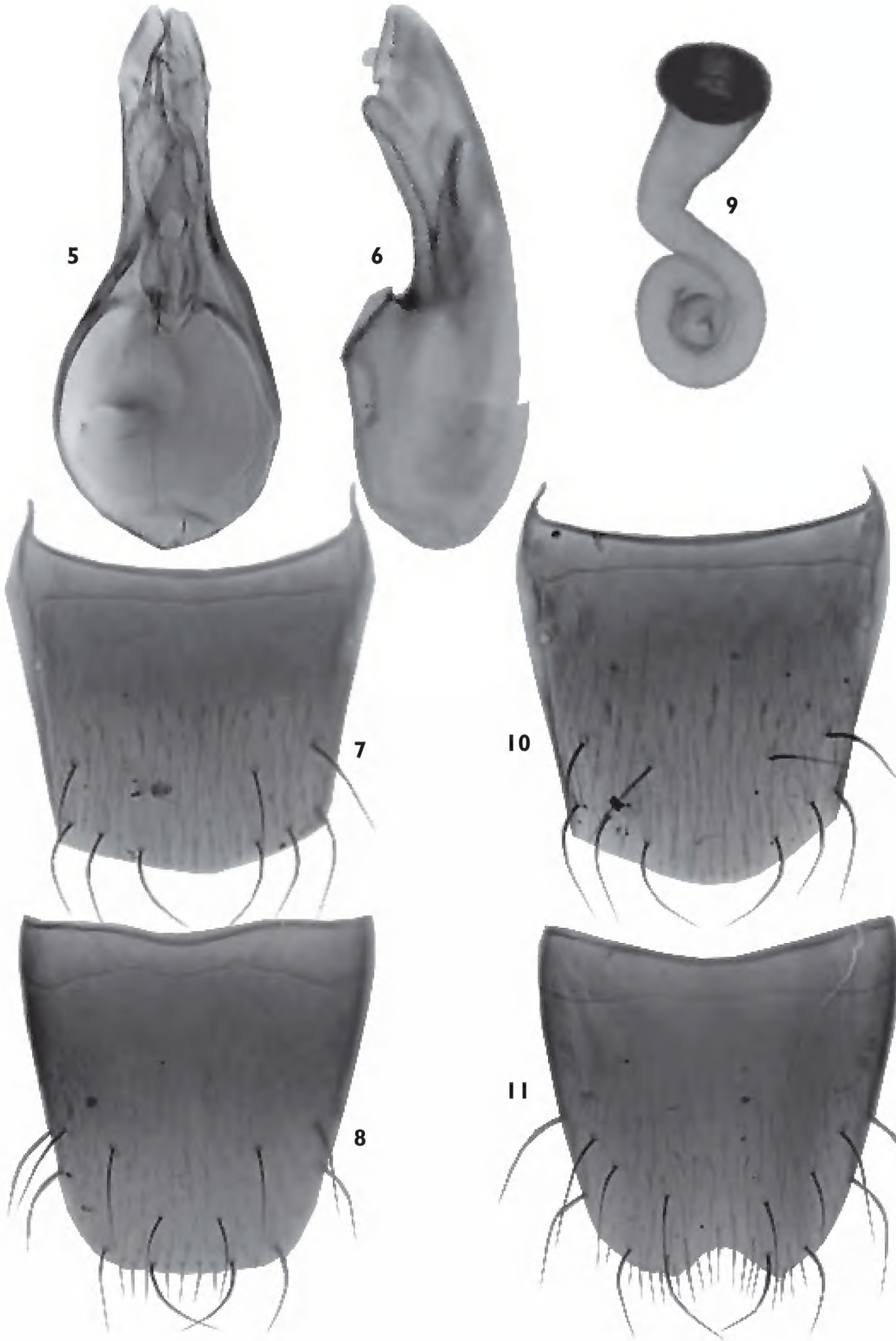
Acrotona avia (Casey, 1910)

NOVA SCOTIA: Antigonish Co.: Pomquet Beach, IV.1996, R.F. Lauff, sand dunes, leaf litter, (1 female; 1 male, NSMC).

Acrotona avia (Fig. 1) is newly recorded in Canada (Fig. 12). *Acrotona avia* was described by Casey (1910) on the basis of specimens collected in Rhode Island. The bionomics of the species are unknown, however, it appears that *A. avia* could be associated with sandy, seacoast environments. Pomquet Beach (45°39'27"N, 61°49'18"W) is a coastal barrier beach that lies between Pomquet Harbour and St. Georges Bay on the Gulf of St. Lawrence in Nova Scotia. The specimens from that locale were collected in a coastal sand dune environment adjacent to a "slack" (a temporary water body lying between two dune crests). Saunderstown (Rhode Island) is located near the mouth of Narragansett Bay where it opens up onto Long Island Sound. The Casey family farm (41°30'44"N, 71°25'23"W), where T.L. Casey lived and carried out collecting (Sikes 2004), is located 0.35 km from the seacoast, immediately adjacent to a barrier beach and coastal lagoon environment very similar to the Pomquet Beach site in Nova Scotia. Although there is no specific information that Casey collected the type specimens from precisely this site, it appears probable that *A. avia* is associated with such coastal environments. *Cercyon litoralis* (Gyllenhal, 1808) [Hydrophilidae] and *Stenus erythropus* Melsheimer, 1844 [Staphylinidae] were collected together with *A. avia* at Pomquet Beach.

Until this present report from Nova Scotia the species has not otherwise been reported from outside Rhode Island. It is likely that it is not as restricted in distribution as these limited records would appear to indicate, but rather as Sikes (2004: 10) pointed out, "...even in well-studied, temperate regions, a great deal of basic taxonomic work remains to be done".

Gusarov (2001-2003) listed this name as a junior synonym of *Acrotona subpygmaea* Bernhauer, 1909. However, we have specimens at hand from New Brunswick (see Kli-



Figs 5-11. Genital structures of *Acrotona avia*: 5-8 male: Fig. 5, median lobe of aedeagus in dorsal view, and Fig. 6 in lateral view; Fig. 7, tergite VIII, and Fig. 8 sternite VIII; figures 9-11 female: Fig. 9, spermatheca; Fig. 10, tergite VIII; Fig. 11, sternite VIII.

maszewski et al. 2005: 14, 15, 34) examined by him and identified as *A. subpygmaea* Bernhauer, which clearly belong to a different species. For this reason we provisionally retain *A. avia* as a distinct species until proper revisionary studies are finalized. We confirm however, that *A. puritana* (Casey, 1910) [originally *Colpodota*] is a junior synonym of *A. avia* (Casey). We were able to examine four syntypes of *A. avia* from Rhode Island, Boston Neck, housed in the Casey collection in Washington (USNM). We designate here the female bearing the following labels as the lectotype: "R.I., a*via* -3 , paralectotype USNM, 38993, Casey bequest 1925", and Gusarov's unpublished paralectotype label: "paralectotypus, *Colpodota avia* Casey, female, V.I. Gusarov des. 2000" (USNM) [genital structures well preserved]. The remaining three specimens then become paralectotypes: R.I., Casey bequest 1925, *avia*-2, paratype USNM 38993, paralectotypus, *Colpodota avia* Casey, male, V.I. Gusarov des. 2000 (USNM) male [aedeagus missing in the attached vial]; R.I. same labels as the lectotype except, *avia*-1, Type USNM 387993, Gusarov's unpublished lectotype designation label 2000 (USNM) 1 female; and R.I., *avia*-4 (USNM) 1 female. We have designated a female specimen as a lectotype because the female of this species may be easily distinguished by having the apical margin of sternite eight deeply emarginate (Fig. 11) and by the shape of the spermatheca (Fig. 9), and because the male genital structures were missing in the only male specimen in the type series. To avoid potential confusion in identification of this species in the future we pro-

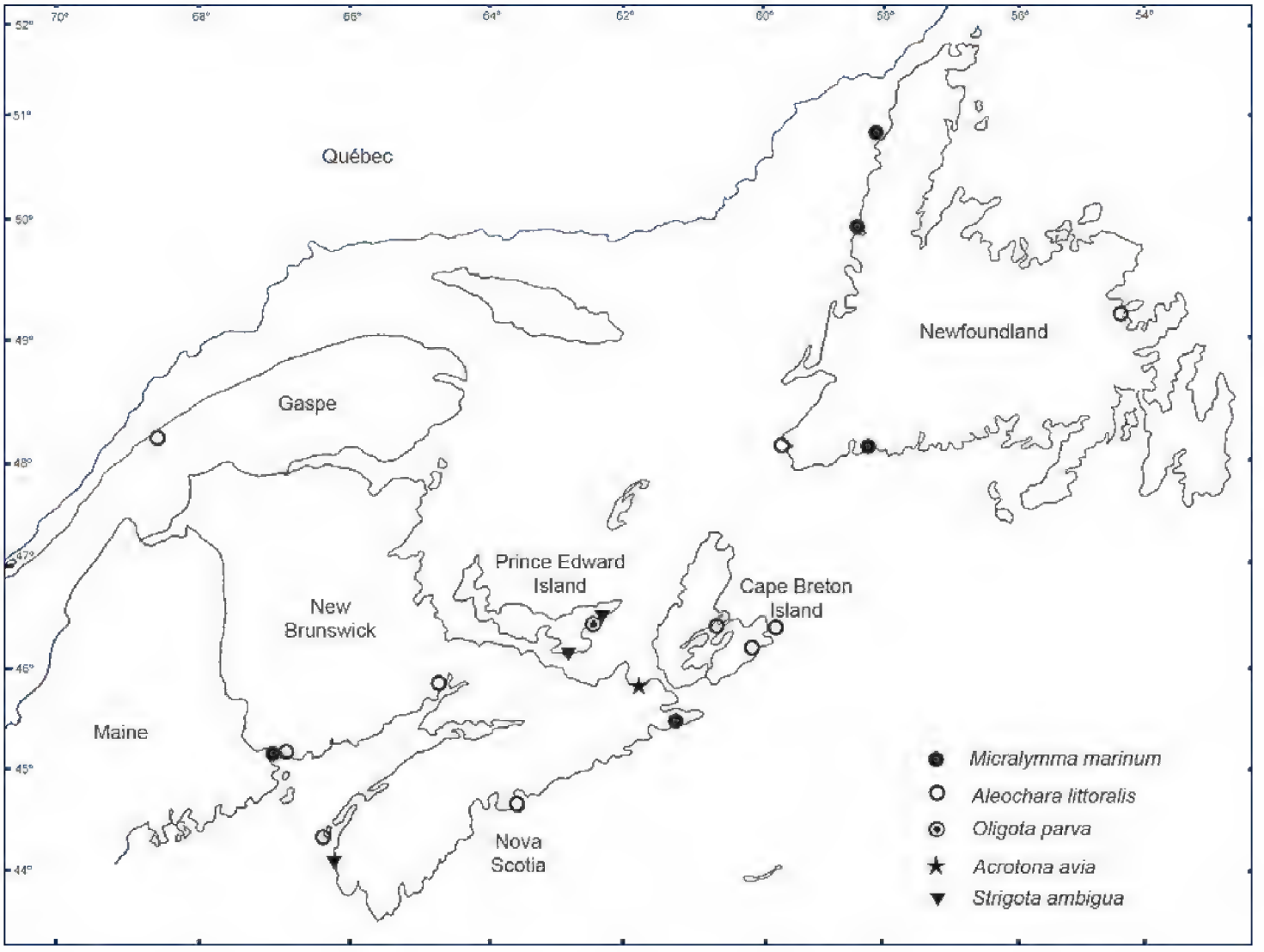


Fig. 12. The distribution of *Micralymma marinum, Aleochara litoralis, Oligota parva, Acrotona avia,* and *Strigota ambigua* in Atlantic Canada.

vide for the first time the images of the body and the genital structures (Figs. 1, 5-11). The body and the genital structures of *A. subpygmaea* (Bernhauer) are published in Figs. 25, 116-119 in Klimaszewski et al. (2005), based on V.I. Gusarov's identification.

Mocyta fungi (Gravenhorst, 1806)

NOVA SCOTIA: Digby Co.: Brier Island, Pond Cove, 10.VIII.2004, J. Ogden and K. Godwin, rocky shore, pitfall trap, (1, JOC); Brier Island, Pond Cove, 15.IX.2004, J. Ogden and K. Godwin, sand dunes, pitfall trap, (1, JOC); **Pictou Co.:** Caribou, 23.VII.2005, C.G. Majka, wet seepage on seashore, (1, CGMC). **PRINCE EDWARD ISLAND: Queens Co.:** Trout River, 28.VI.2003, C.G. Majka, on dung at edge of brackish marsh, (1, CGMC).

Gusarov (2001-2003) reported this species from New Brunswick and Majka and Klimaszewski (2008) reported it from Nova Scotia and Prince Edward Island. Its distribution in the Maritime Provinces is shown in Majka and Klimaszewski (2008). Most of the specimens collected in Atlantic Canada are from agricultural fields, however, there are some records (above) from coastal habitats. Hammond (2000) includes it as a generalist species found in the upper levels of salt marshes in Great Britain.

Strigota ambigua (Erichson, 1839)

NOVA SCOTIA: Digby Co.: Beaver River, 16-23.VII.1993, J. Cook, sand dunes, pitfall trap, (5, JCC). **PRINCE EDWARD ISLAND: Kings Co.:** Launching, 26.VIII.2003, C.G. Majka, coastal barrier beach: beneath coastline drift at the top of the littoral zone, (4, CGMC).

Strigota ambigua (Fig 3.) is newly recorded in Canada (Fig. 12). It is widespread in the United States across a band from Connecticut, New York and New Jersey, south to North Carolina, west through Iowa, Missouri, Kansas, and Texas, to Colorado, New Mexico, Nevada, and California on the Pacific coast (Gusarov 2003). Almost nothing is known of the bionomics of this species. Gusarov (2001-2003) recorded it from along riverbanks and in flood refuse. All the specimens found in the Maritime Provinces have been in sand dune and beach-drift environments. At Beaver River, NS other characteristic coastline species collected with *S. ambigua* include *Hypocaccus fraternus, Stenus erythropus, Aegialia opifex* Horn, 1887, and *Blapstinus metallicus*. For co-occurring coastline species found at Launching (PEI) see the preceding account on *Oligota parva*.

Atheta novaescotiae Klimaszewski and Majka, 2006

NEW BRUNSWICK: Albert Co.: Mary's Point, 12.VIII.2004, C.G. Majka, ocean beach: beneath coastline drift, (3, CGMC).

Atheta novaescotiae was described by Klimaszewski et al. (2006). Its distribution in Nova Scotia, Newfoundland, and the French territory of Saint-Pierre et Miquelon is shown in Klimaszewski et al. (2006). It is herein newly recorded in New Brunswick. It is found only in beach-drift environments at the upper end of the littoral zone on both sandy and rocky oceanic beaches in Atlantic Canada. For further information on co-occurring Coleoptera see Klimaszewski et al. (2006).

Atheta acadiensis Klimaszewski and Majka, 2007

Atheta acadiensis was described by Klimaszewski and Majka (2007) from beach-drift environments on oceanic beaches. Its distribution in New Brunswick, Nova Scotia, Québec, and Prince Edward Island is shown in Klimaszewski and Majka (2007). Majka *et al.* (in press) recorded it from under wrack on sea beaches on Scatarie Island, Nova Scotia. Specimens are found in the narrow and well-defined ecological zone within beach-drift material at the top of the littoral zone. For further information on co-occurring Coleoptera see Klimaszewski and Majka (2007).

Atheta vestita (Gravenhorst, 1806)

NEW BRUNSWICK: Albert Co.: Mary's Point, 12.VIII.2004, C.G. Majka, sandy shore, beach drift, (7, CGMC); Shepody National Wildlife Area, 31.V.2004, R.P. Webster, sea beach, beach drift material, (3, RWC). **NOVA SCOTIA: Cape Breton Co.:** Sydney, South Bar, 20.VI.1996, D.B. McCorquodale, (1, CBU); **Digby Co.:** Brier Island, Pond Cove, 22.VI.2003, J. Ogden and K. Goodwin, rocky shore, pitfall trap, (1, JOC).

Atheta vestita is a Palearctic species newly recorded in North America from New Brunswick by Klimaszewski et al. (2006) in beach drift material. Its distribution in North America is shown in Fig. 13. In Scandinavia, the Baltic region, Great Britain, Greenland, Iceland, and the Faroe Islands this macropterous species is found almost exclusively on sandy and gravelly seashores where it occurs beneath decaying seaweed on the strand line (Lindroth 1931; Larsson and Gígja 1959; Böcher 1988), however, in the Faroe Islands it has also been reported from grassland and waste land environments close to the seashore (Bengtson 1981). Given the maritime biology of this species, and the distribution of this species around the margins of the North Atlantic, further investigations should be conducted in Atlantic Canada and New England to determine the extent of its distribution and to examine whether it might be a naturally-occurring Holarctic species.

Falagria dissecta Erichson, 1839

Hoebeke (1985) recorded this species from New Brunswick and Nova Scotia. Davies (1979) found it in seaweed beach wrack in St. Andrews, New Brunswick. Howden (1970) and Wright (1989) recorded it from pond-edge debris on Sable Island, NS,

and Hoebeke (1985) noted that it occurs in beach debris. Its distribution in Atlantic Canada is shown in Fig. 13. Hoebeke (1985) erroneously plotted the Sable Island (160 km off the Atlantic coast of Nova Scotia) records as being from Cape Sable Island (in southwestern Nova Scotia). It is a species found in many decompositional situations (Hoebeke 1985) that only occurs sporadically in coastline environments.

Myrmecopora vaga (LeConte, 1866)

NOVA SCOTIA: Halifax Co.: Point Pleasant Park, 23.VI.2002, C.G. Majka, small beach, in flotsam, (1 female, CGMC).

Myrmecopora vaga (Fig. 4) is newly recorded in Canada (Fig. 13). The specimen was collected on a small sandy beach along the Northwest Arm in Point Pleasant Park. Several individuals were observed in the vicinity of beach-drift detritus accumulated at the top of the strand line. They were, however, quick to take flight and agile on the wing, and only one specimen was captured. Other characteristic co-inhabiting coastline species of beetles collected together with *M. vaga* at this site were *Cercyon litoralis*, *Dermestes undulatus* Brahm, 1790 [Dermestidae], and *Blapstinus metallicus*.

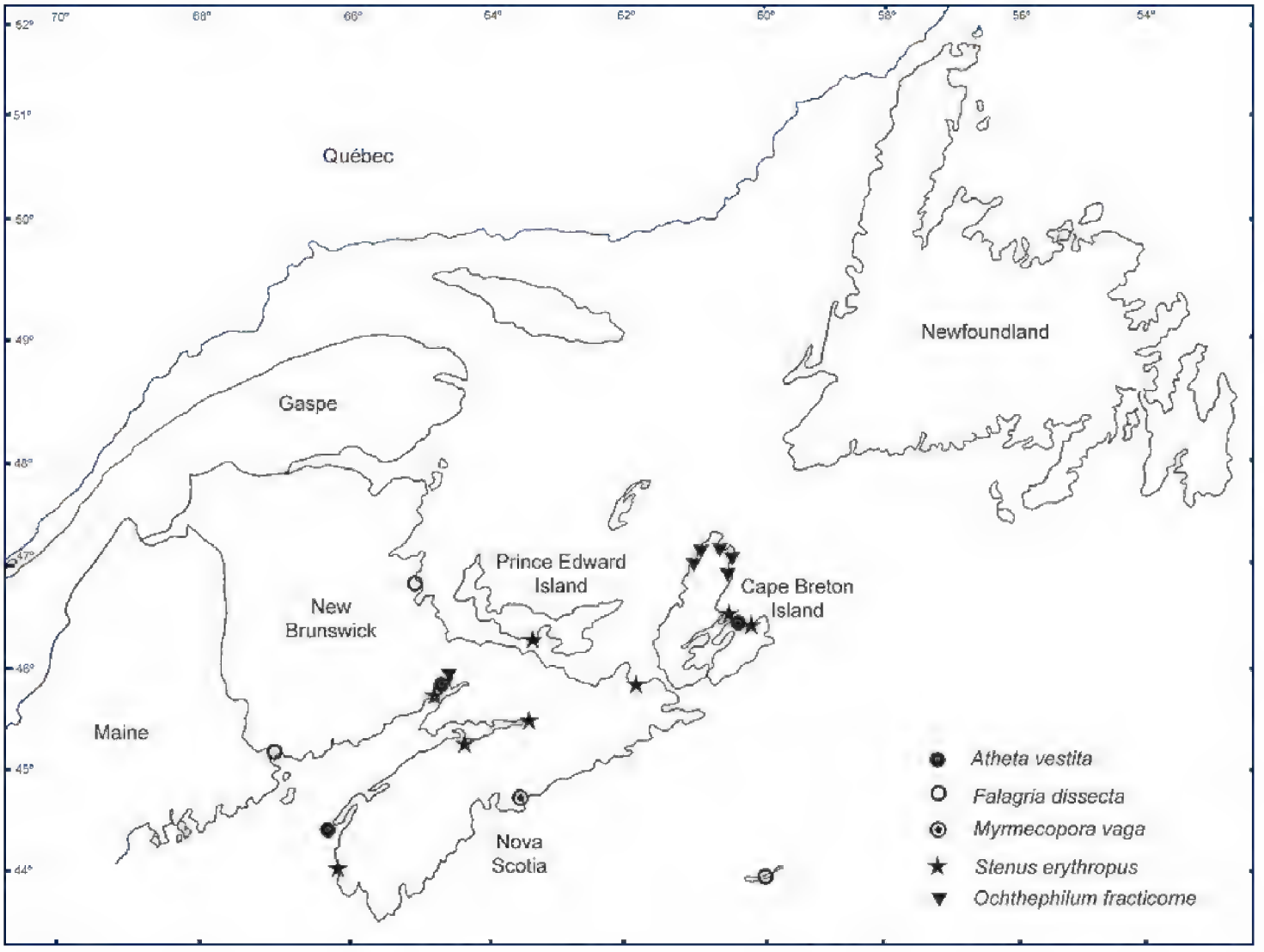


Fig. 13. The distribution of *Atheta vestita, Falagria dissecta, Myrmecopora vaga, Stenus erythropus,* and *Ochthephilum fracticorne* in Atlantic Canada.

Myrmecopora vaga was described by LeConte (1866) from the "Lake Superior" region of the United States where it was found in the riparian areas of lakes and streams (Newton et al. 2000). The present record is the first subsequent record, and the first one from eastern North America. While the species was found in riparian areas in the interior of the continent, it was discovered on the coastline in Nova Scotia. This may be a typical habitat for this little-known species given that many Western Palaearctic species of *Myrmecopora* are known to inhabit coastline, beach-drift, and shingle-beach environments where they are typically found beneath seaweed and other debris accumulated on the strand line (Assing 1997a, 1997b). These include *M. fugax* (Erichson, 1839), *M. laesa* (Erichson, 1839), *M. uvida* (Erichson, 1840), *M. boehmi* Bernhauer, 1910, *M. oweni* Assing, 1997, *M. sulcata* (Kiesenwetter, 1850), *M. simillima* (Wollaston, 1864), *M. maritima* (Wollaston, 1864), *M. minima* Bernhauer, 1900, *M. anatolica* (Fagel, 1969), *M. bernahueri* Koch, 1936, and *M. brevipes* Butler, 1909 (all the species in the subgenera *Iliusa*, *Paraxenusa*, and *Xenusa*); and in the eastern portion of the Palaearctic region, *M. rufescens* (Sharp, 1874), *M. algarum* (Sharp, 1874), *M. reticulata* (Assing, 1997), and *M. chinensis* Cameron, 1944 (all the species in the subgenus *Lamproxenusa*). Consequently this species should be sought more extensively in both riparian and seacoast situations in North America in order to better determine its distribution on the continent.

Oxytelinae

Bledius basalis LeConte, 1877

NEW BRUNSWICK: Queens Co.: Jemseg, 8.VI.2003, R.P. Webster, silver-maple forest, moist bare clay, (1, RWC). **NOVA SCOTIA: Annapolis Co.:** Melveryn Square, 24.VI.1992, E. Georgeson, light trap, (9, NSNR); **Halifax Co.:** Petpeswick, 23.VI.1971, B. Wright, (2, NSMC).

Bledius basalis is newly recorded in New Brunswick. Its distribution in Atlantic Canada is shown in Fig. 14. Herman (1976) indicated that the species was found in coastal habitats from Texas north to Rhode Island. Howden (1970) recorded the species from Sable Island (Nova Scotia), the only previously known Canadian location. The above specimens collected from Petpeswick and Melveryn Square establish the occurrence of this species on the mainland of Nova Scotia.

All the sites where this species has been recorded in the United States are coastal and most are slightly moist, slightly vegetated sand flats adjacent to the ocean (Herman 1976). This is true of Petpeswick, a sandy inlet on the Atlantic coast of Nova Scotia. Melveryn Square, however, lies in the Annapolis Valley of Nova Scotia, although it is only 9 km from "Sand Banks", a sandy coastal beach on the Bay of Fundy, and *B. basalis* is macropterous and a capable flier. Jemseg (New Brunswick) is 70 km inland from the Bay of Fundy, however, it is located on the shores of Grand Lake, which at 174 km^2, is the largest freshwater body in Atlantic Canada. This would ap-

pear to indicate that *B. basalis*, while occurring predominantly in coastal localities, can also be found in appropriate inland sites away from the ocean.

Bledius mandibularis Erichson, 1840

NOVA SCOTIA: Lunenburg Co.: Backmans Beach, 28.VII.1971, B. Wright, (1, NSMC).

Bledius mandibularis is newly recorded in Nova Scotia and Atlantic Canada. Its distribution in Atlantic Canada is shown in Fig. 14. In North America there are two populations; a coastal one occurring from southern Texas to Massachusetts, and an inland one found in the central regions of the United States, north to southern Manitoba (Herman 1972). The coastal population is found on bare, moist ground in saline habitats, generally on the leeward side of islands or peninsulas and behind beach dunes (Herman 1972). Backmans Beach is a small island at the tip of the Second Peninsula in Lunenburg County which is linked to the mainland via a barrier beach. It has six variously sized barrier beach-coastal lagoon areas with associated marshlands and sand flats.

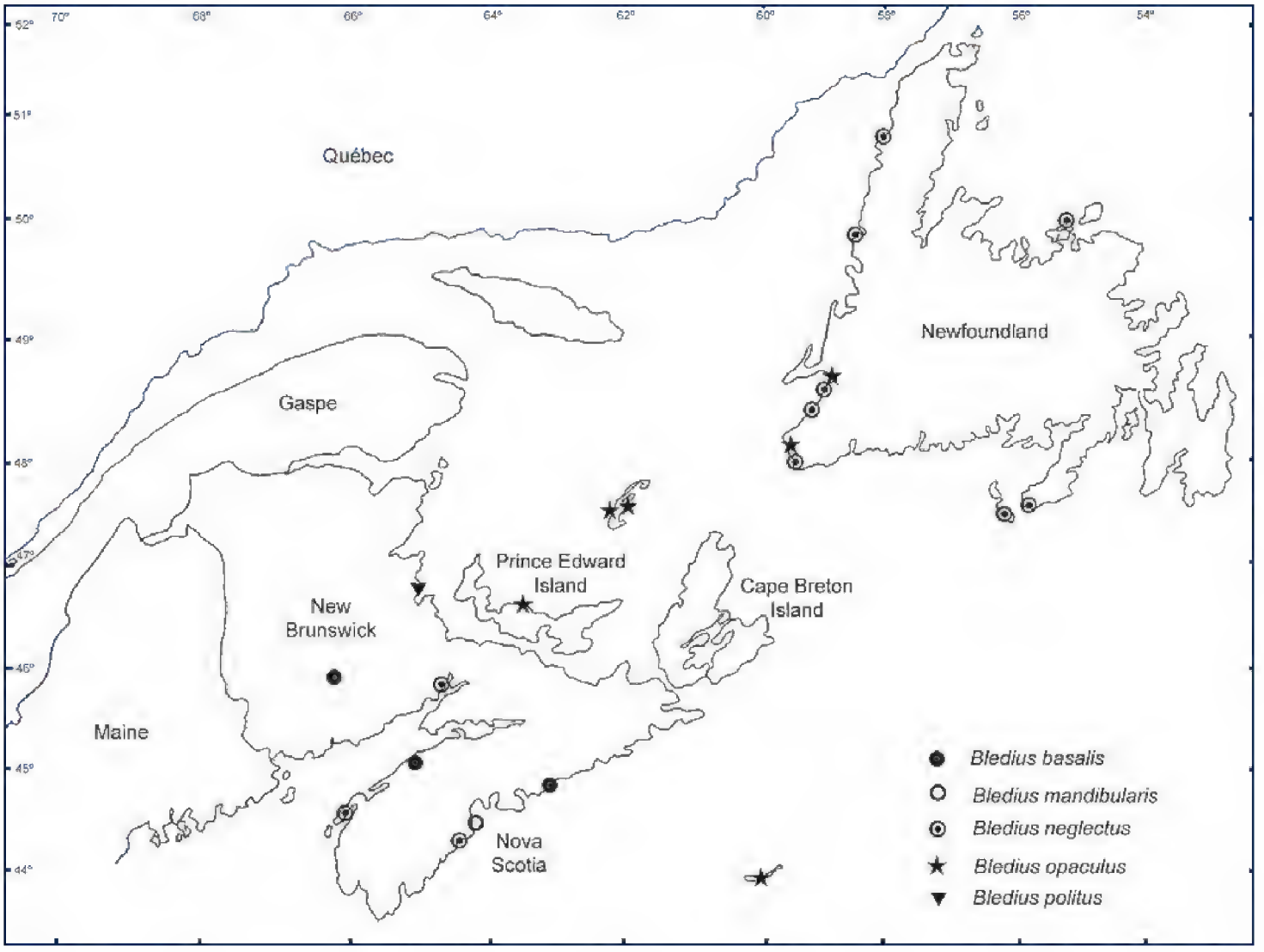


Fig. 14. The distribution of *Bledius basalis, Bledius mandibularis, Bledius neglectus, Bledius opaculus,* and *Bledius politus* in Atlantic Canada.

Bledius neglectus Casey, 1889

NEW BRUNSWICK: Albert Co.: Mary's Point, 12.VIII.2004, C.G. Majka, coastal barrier beach: coastline drift, (4, CGMC). **NOVA SCOTIA: Digby Co.:** Sandy Cove, 4.VIII.1971, B. Wright, (1, NSMC).

Herman (1976) recorded this species from Newfoundland, Nova Scotia (the Atlantic coast), and the French territory of Saint-Pierre et Miquelon. Its distribution in Atlantic Canada is shown in Fig. 14. Campbell and Davies's (1991) checklist included the species from New Brunswick without, however, providing any records. The above records establish its presence in New Brunswick and indicate that the species occurs on both the Nova Scotia and New Brunswick shores of Bay of Fundy. It is found on moist, un-vegetated sand flats on the leeward sides of islands and peninsulas, as well as in the intertidal zone. It has been collected in the region in association with the predaceous carabids *Dyschirius sphaericollis* Say and *Dyschirius pallipennis* Say (Herman 1976).

Bledius opaculus LeConte, 1877

NOVA SCOTIA: Halifax Co.: Sable Island, 22.VII.1976, 13.VI.1977, 14.VI.1977, wet sand at the edges of ponds, B. Wright, (6, NSMC). **PRINCE EDWARD ISLAND: Queens Co.:** Cavendish Beach, 22.VII.1967, H.F. Howden, (1, CNC). **QUÉBEC:** Iles de la Madeleine, 7-9.VII.1992, F. Shaeffer and P. Laporte, 322 specimens, Majka and Shaffer (in press).

Herman (1976) recorded this species from Newfoundland, Nova Scotia (Sable Island), and Prince Edward Island (Fig. 14). In Nova Scotia the species has only been recorded from Sable Island (Howden 1970, Wright 1989). More recently Majka and Shaffer (in press) recorded large numbers in the diet of Piping Plovers in the Iles de la Madeleine, Québec, newly recording the species from that province.

Herman (1976) found the species on moist, un-vegetated sand flats on the leeward side of an island and on algae covered moist sand flats. On Sable Island specimens have been found associated with dead gulls, in large swarming groups along the shores of Wallace Lake, and on wet sand at the edge of small ponds (Wright 1989). In the Iles de la Madeleine they are found on moist sand flats in the lee of large barrier beaches (Majka and Shaffer in press). The species' distribution in Atlantic Canada is shown in Fig. 14.

Bledius politus Erichson, 1840

NEW BRUNSWICK: Kent Co.: Kouchibouguac National Park, 2.VII.1977, J.R. Vockeroth, (1, CNC).

Bledius politus was recorded from New Brunswick by Campbell and Davies (1991) on the basis of the record above (shown in Fig. 14). It is associated with

coastal areas, as well as inland swamps and lakes, and is found in slightly moist, heavily vegetated sand (Herman 1976).

Steninae

Stenus (Stenus) erythropus Melsheimer, 1844

NEW BRUNSWICK: Albert Co.: Mary's Point, 12.V.2007, C.G. Majka, coastline, (1, CGMC). **NOVA SCOTIA:** Pomquet Beach, IV.1996, R.F. Lauff, sand dunes, leaf litter, (2 female; 1 male, STFX). **Digby Co.:** Beaver River, 16-23.VII.1993, J. Cook, coastline, pitfall trap, (1, JCC). **PRINCE EDWARD ISLAND: Queens Co.:** Meadowbank, 27.V.1981, E.L. Drake, (1, UPEI).

Stenus erythropus is newly recorded on Prince Edward Island. Its distribution in Atlantic Canada is shown in Fig. 13. It was previously recorded from New Brunswick and Nova Scotia (Campbell and Davies 1991). *Stenus erythropus* is not a species hitherto noted from coastal habitats, and indeed there are a number of specimen records in the Maritime Provinces from inland, non-marine situations (unpublished data). Like many species in this genus they are frequently encountered near streams or in other aquatic situations (Newton et al. 2000). As the above records indicate, in the Maritime Provinces they are occasionally found in coastal marshy and/or sand dune environments.

Paederinae

Ochthephilum fracticorne (Paykull, 1800)

NEW BRUNSWICK: Albert Co.: Mary's Point, 23.VIII.2003, C.G. Majka, coastal dunes; under flotsam, (1, CGMC). **NOVA SCOTIA: Victoria Co.:** South Harbour, 16.VI.1983, Y. Bousquet, sand beach, (1, CNC); Ingonish North Bay, 29.VI.1983, L. LeSage, salt marsh, pile of decaying vegetation, (1, CNC).

Majka and Klimaszewski (2008) reported this species from New Brunswick. Its distribution in Atlantic Canada is shown in Fig. 13. *Ochthephilum fracticorne* has not been noted in Europe as a coastal species but rather is regarded as a synanthropic one found in fields, parks, litter, decomposing hay, and compost (Drugmand 1989). D.S. Chandler (pers. comm.) has recorded it coastal habitats in New Hampshire and the above records from New Brunswick and Nova Scotia indicate that it is at least an occasional inhabitant of such environments (Fig. 13). *Ochthephilum jacquelini* (Boieldieu, 1859), however, is a halobiont found exclusively in salt marshes in Great Britain (Hammond 2000). There is some uncertainty about the zoogeographic status of *O. fracticorne*. Campbell and Davies (1991) listed it as a Holarctic species but Drugmand (1989) treated it as a Palearctic species.

Staphylininae

Gyrohypnus angustatus Stephens, 1832

This species was recorded from New Brunswick, Newfoundland, and Nova Scotia by Smetana (1982). Davies (1979) found this introduced Palearctic species in seaweed beach wrack in St. Andrews, New Brunswick. Its distribution in Atlantic Canada is shown in Fig. 15. Smetana (1982) noted rotting seaweed as one of the habitats where the species has been found in North America and Lindroth (1957) found it at every one of the southern English coastal sites that he surveyed where dry ballast destined for North America originated. This not only indicates habitat preferences, but also a possible mechanism for the introduction of this species to North America.

Xantholinus linearis (Olivier, 1795)

NEW BRUNSWICK: Albert Co.: Mary's Point, 9.VIII.2002, seashore, under beach-drift, (1, CGMC). **NOVA SCOTIA: Inverness Co.:** Inverness Beach, 17.VIII.1994,

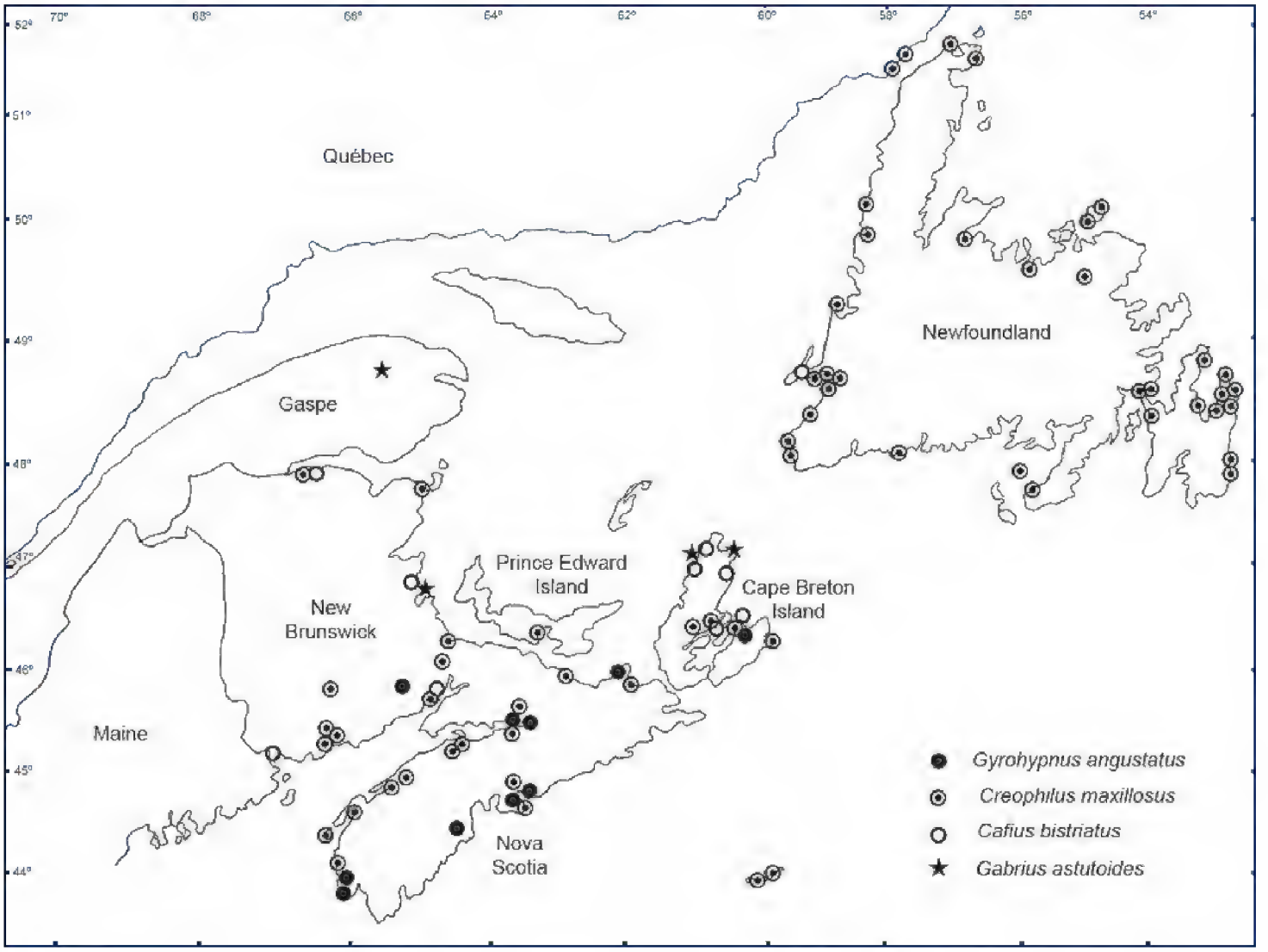


Fig. 15. The distribution of *Gyrohypnus angustatus, Creophilus maxillosus villosus, Cafius bistriatus,* and *Gabrius astutoides* in Atlantic Canada.
Note: Two sites from central Labrador (Goose Bay and Cartwright) are not shown on the map.

J. M. Francis and V. Jessome, (1, CBU); **Kings Co.:** Lyons Cove, 30.VII.2006, D.H. Webster, in weathered wrack, (1, DHWC). **Shelburne Co.:** Lydgate, 6.VII.1968, P.S. Doleman, (1, NSMC); Lockeport, 1.IX.1968, P.S. Doleman, (1, NSMC). **PRINCE EDWARD ISLAND: Queens Co.:** Trout River, 28.VI.2003, C.G. Majka, on dung at edge of brackish marsh, (1, CGMC).

Xantholinus linearis is an abundant and widely distributed species in the Maritime Provinces (Majka and Klimaszewski 2008). Its distribution in the Maritime Provinces is shown in Majka and Klimaszewski (2008). There are many records from both synanthropic and natural inland habitats, however, the above records indicate that it is occasionally found in coastal environments in the region. Hammond (2000) includes it as a generalist species regularly reported from saline and intertidal situations in Great Britain.

Creophilus maxillosus villosus (Gravenhorst, 1802)

NEW BRUNSWICK: Albert Co.: Mary's Point, 7.VI.2006, D.S. Christie, on dead Minke Whale, (2, CGMC). **NOVA SCOTIA: Antigonish Co.:** Pomquet Beach, 29.VIII.2000, H.J. Watts, coastal beach, (1, STFX); Pomquet Beach, 6.V.2004, M.A. Rossong, coastal beach, (1, STFX); Pomquet Beach, 16.V.2001, B.F. Leahey, coastal beach, (1, STFX); **Cape Breton Co.:** Scatarie Island, Savage Cove, 10.VIII.2005, K.R. Aikens, sea beach under wrack, (1, CBU); South Bar, 3.VIII.1995, A. Brown, (1, CBU); **Digby Co.:** Brier Island, Pond Cove, 28.VII.2003, 15.IX.2004, J. Ogden & K. Goodwin, rocky shore, pitfall trap, (3, JOC); Mavilette Beach, 20.VII.1993, J. & T. Cook, beach dune, under driftwood, (1, JCC); **Halifax Co.:** Sable Island, 20.VI.1976, 9.VI.1977, 10.VI.1977, 12.VI.1977, 12.IX.1977, B. Wright, (17, NSMC); **Shelburne Co.:** Cape Sable Island, Daniel's Head Beach, 18.VIII.2007, R. Gorham, on seal carcass, (1, NSMC).

This cosmopolitan species has been known in the Maritime Provinces since 1827-28 from collections made in Nova Scotia by Captain Basil Hall (Kirby 1837) and Prévost and Bain (2007) found it in deposits dated 1620 in Newfoundland. Its distribution in the Maritime Provinces is shown in Fig. 15. As the above records indicate, it is frequently encountered in coastal situations (where adults and larvae feed on maggots found on various kinds of carrion and decaying matter), however, it also occurs in many kinds of natural habitats and in synanthropic situations (Newton et al. 2000). Newton et al. (2000) pointed out that the North American specimens of the subspecies *C. maxillosus villosus*, are distinguishable from the Palaearctic *C. m. maxillosus*. *Creophilus m. villosus* has a broad pre-human North American distribution, and hence can be considered a native, Nearctic subspecies.

Tasgius (Tasgius) ater (Gravenhorst, 1802)

NEW BRUNSWICK: Albert Co.: Mary's Point, 9.VIII.2002, C.G. Majka, barrier beach, under rock, (1, CGMC); **Gloucester Co.:** Saint Simon, 21.VIII.1983, P. Mal-

let, (1, UMNB). **NOVA SCOTIA: Antigonish Co.:** Pomquet Beach, 2.IX.1996, R.F. Lauff, (1, STFX); **Halifax Co.:** West Dover, 7.IX.2003, C.G. Majka, seashore, coastal barrens, (1, CGMC); Sable Island, 5.VIII.1969, F.W. Scott, (3, NSMC); Sable Island, 9.IX.1977, 10.IX.1977, B. Wright, under boards, (2, NSMC); **Lunenburg Co.:** Petite Rivière, 3.IX.1954, D.C. Ferguson, (1, NSMC); **Queens Co.:** White Point Beach, 5.VIII.1953, J.H. McDunnough, (1, NSMC); **Shelburne Co.:** Bon Portage Island, 31.VII.1997, R.F. Lauff, (1, STFX); **Yarmouth Co.:** Port Maitland, 9.VIII.1988, J. Cook, beach, (1, JCC). **PRINCE EDWARD ISLAND: Queens Co.:** Cavendish, 14.VII.2002, C.G. Majka, coastal lagoon, under rock, (1, CGMC); North Rustico, 13.VII.2001, C.G. Majka, seashore, under rock, (1, CGMC).

Majka and Klimaszewski (2008) newly recorded *Tasgius ater* in New Brunswick and on Prince Edward Island. Its distribution in the Maritime Provinces is shown in Majka and Klimaszewski (2008). It is also recorded from Newfoundland (Campbell and Davies 1991). As the above records indicate, this introduced species is often found beneath wood and stones at coastal sites, although it is also found in inland locations. It is a widely distributed Palearctic species known in North America since at least 1802 (Majka and Klimaszewski 2008).

Cafius bistriatus (Erichson, 1840)

NEW BRUNSWICK: Albert Co.: Mary's Point, 23.VIII.2003, C.G. Majka, coastal dunes, under flotsam, (1, CGMC); **Charlotte Co.:** Pottery Beach, Passamaquoddy Bay, 29.VII.1976, M.J. Dadswell, (2, CNC); **Kent Co.:** Kouchibouguac National Park, 1.VI.1977, S.J. Miller (1, CNC); Kouchibouguac National Park, 13.IX.1977, J.M. Campbell, (1, CNC); Restigouche Co.: River Charlo, 24.VII.1972, J.M. Campbell. (1, CNC). **NOVA SCOTIA: Cape Breton Co.:** Point Aconi, 13.VII.1972, J.M. and B.A. Campbell, (1, CNC); Big Bras d'Or, 25.VII.1972, J.M. Campbell, (1, CNC); **Inverness Co.:** Cape Breton Highlands National Park: Presqu'île, 13.IX.1984, sifting beach wrack, (40, CNC); 2.5 km SE of Cap Rouge, 14.XI.1984, A. Smetana, (8, CNC); Pleasant Bay, 27.V.1984, L. Masner, sea-beach kelp, (2, CNC); Pleasant Bay, 29.VII.1983, D.E. & J.E. Bright, seashore kelp, (2, CNC); **Victoria Co.:** Big Bras d'Or, 25.VII.1972, J.M. Campbell, (1, CNC); North Bay Ingonish, Cape Breton Highlands National Park, 29.VI.1983, L. LeSage, seashore wrack, (1, CNC).

Cafius bistriatus was recorded in the Maritime Provinces by Frank et al. (1986) and Campbell et al. (1987) and from Newfoundland by Smetana (1965). Its distribution in Atlantic Canada is shown in Fig. 15. It is common in wrack and other debris on marine beaches (Newton et al. 2000). James et al. (1971) reported that *Cafius* species lay their eggs deep in sand where their larvae prey on amphipods, flies of the genus *Fucellia*, and small barnacles. Two abundant amphipods associated with Coleoptera in beach drift environments in the Maritime Provinces are *Talorchestia longicornis* (Say, 1818) in the upper littoral and splash zone, and *Orchestia gammarella* Pallas, 1766 in beach drift slightly lower down on the coastline (Klimaszewski and Majka 2006). *Tal-*

orchestia megalophthalma (Bate, 1862), *O. platensis* Kroyer, 1845, and *O. grillus* (Bosc, 1802) are also present in the region (Gosner 1971).

Gabrius astutoides (A. Strand, 1946)

NEW BRUNSWICK: Kent Co.: Kouchibouguac National Park, 30.V.1977, S.J. Miller, (1, CNC); Kouchibouguac National Park, 16.IX.1977, J.M. Campbell & A. Smetana, (2, CNC). **NOVA SCOTIA: Inverness Co.:** Pleasant Bay, 28.V.1984, H. Goulet, (1, CNC); **Victoria Co.:** White Point, 23.VI.1983, Y. Bousquet, (1, CNC).

Gabrius astutoides was recorded from New Brunswick and Nova Scotia by Smetana (1995). Its distribution in Atlantic Canada is shown in Fig. 15. Although habitat information was not recorded for these specimens, they were all collected at coastal sites (Fig. 15). Hammond (2000) recorded this species in Britain as commonest in coastal habitats.

Philonthus carbonarius (Gravenhorst, 1802)

NOVA SCOTIA: Digby Co.: Brier Island, Pond Cove, 8.VII.2003, J. Ogden and K. Goodwin, sand dunes, (1, JOC); **Halifax Co.:** Sable Island, B. Wright, (2, NSMC); Cow Bay, 21.V.1953, 29.IX.1954, 23.VIII.1955, C.J.S. Fox, (4, ACNS); **Shelburne Co.:** Bon Portage Island, 28.VIII.2002, D.B. McCorquodale, (1, CBU); **Yarmouth Co.:** Chebogue, 1.VIII.1952, 4.VI.1953, 2.V.1954, 24.IX.1954, C.J.S. Fox, (6, ACNS).

Philonthus carbonarius is widely distributed throughout Atlantic Canada (Smetana 1995, Majka and Klimaszewski 2008). Its distribution in North America is shown in Smetana (1995). This introduced Palearctic species was first recorded in Newfoundland in 1905 and Nova Scotia in 1909 (Smetana 1995). It is a common species occurring in a wide variety of synanthropic habitats, but also on sea beaches under decaying seaweed (Smetana 1995) as is evident from the records cited above.

Philonthus cognatus Stephens, 1832

NOVA SCOTIA: Colchester Co.: Five Islands Park, 10.VI.1988, E. Georgeson, UV light trap, (1, NSNR); **Halifax Co.:** Sable Island, 22.IV.1976, 23.VII.1976, B. Wright, under dead grass, boards, & debris, (2, NSMC). **PRINCE EDWARD ISLAND: Queens Co.:** Cavendish, 14.VII.2002, C.G. Majka, coastal lagoon, under rock, (1, CGMC); **Prince Co.:** Belmont Park, 9.VII.1988, Y. Bousquet, (1, CNC).

Philonthus cognatus is an introduced Palearctic species, widely distributed in both eastern and western North America (there are few records from the central portions of the continent). Its distribution in North America is shown in Smetana (1995). Smetana (1995) records it from a wide range of habitats. Hammond (2000) includes

it as a generalist species found in the upper levels of salt marshes in Great Britain. It is a common species in Atlantic Canada and there are some records from coastal environments (Wright 1989), however, it is primarily found in synanthropic inland situations.

Philonthus couleensis Hatch, 1957

NOVA SCOTIA: Halifax Co.: Sable Island, 5-12.VII.1967, H. Howden, (1, CNC); **Victoria Co.:** Dingwall, 20.IX.1984, J.M. Campbell and A. Davies, (1, CNC).

Smetana (1995: 331) wrote, "*Philonthus couleensis* is a pronouncedly hygrophilous species, occurring in a wide variety of wet habitats … even in marshy habitats along sea beaches". There are scattered records in New Brunswick, Newfoundland, and Nova Scotia (Smetana 1995) including a few from coastal habitats. Its distribution in North America is shown in Smetana (1995).

Philonthus furvus Nordman, 1837

NEW BRUNSWICK: Charlotte Co.: St. Andrews, 17.VIII.1955, J.R. Vockeroth, (1, CNC). **NOVA SCOTIA: Digby Co.:** Brier Island, Pond Cove, 28.VII.2003, 15.IX.2004, J. Ogden & K. Goodwin, beach drift on rocky cobble shore, pitfall trap, (4, JOC).

Smetana (1995: 96) wrote, "*Philonthus furvus* is a distinctly hygrophilous species, occurring in all kinds of wet habitats, such as edges of lakes and ponds, marshes and swamps, banks of rivers and creeks, wet forests, seepages, etc." Davies (1979) found this species was apparently well-adapted to, and dependant on, beach-wrack environments in St. Andrews, New Brunswick. The above records from Brier Island (NS) are from a similar environment. Its distribution in North America is shown in Smetana (1995).

Philonthus politus (Linnaeus, 1758)

NOVA SCOTIA: Cape Breton Co.: Scatarie Island, Northwest Cove, 8.VIII.2005, A. MacDonald, under wrack on beach, (1, CBU); Scatarie Island, Northwest Cove, 11.VIII.2005, K.R. Aikens and A. MacDonald, under wrack on beach, (1, CBU); **Digby Co.:** Brier Island, Pond Cove, 15.IX.2005, J. Ogden and K. Goodwin, rocky shore, pitfall trap, (1, JOC); **Halifax Co.:** Sable Island, 10.VI.1977, 15.VI.1977, B. Wright, (4, NSMC).

Philonthus politus is found in all kinds of decaying organic matter (Smetana 1995). It is not particularly associated with coastal habitats. There are scattered records in New Brunswick, Newfoundland, and Nova Scotia (Smetana 1995) including a few (above) from coastal habitats. Its distribution in North America is shown in Smetana (1995).

Philonthus umbratilis (Gravenhorst, 1802)

NOVA SCOTIA: Victoria Co.: Ingonish Beach, 27.IX.1974, A. Davies, (1, CNC).

Smetana (1995) observed that this species is found in a wide range of habitats. Davies (1979) found this species was frequent in coastal beach-wrack habitats, but also found in other environments, in St. Andrews, New Brunswick. It has not been noted as a coastal species in Great Britain (Hammond 2000). Its distribution in North America is shown in Smetana (1995).

Philonthus varians (Paykull, 1789)

PRINCE EDWARD ISLAND: Prince Co.: Belmont Park, 9.VII.1988, Y. Bousquet, (1, CNC).

Davies (1979) found this introduced Palearctic species in seaweed beach wrack in St. Andrews, New Brunswick. According to Smetana (1995: 240) "*Philonthus varians* occurs in all kinds of decaying organic matter … specimens were also collected under rotting seaweeds on sea beaches …". It is abundant in many portions of the Atlantic Provinces (Smetana 1995; unpublished data). Its distribution in North America is shown in Smetana (1995). It was first recorded in the region in New Brunswick in 1900-1907 (Majka and Klimaszewski 2008). Hammond (2000) includes it as a generalist species regularly reported from saline and intertidal situations in Great Britain.

Discussion

Thirty-three species of coastline inhabiting Staphylinidae have now been recorded in Atlantic Canada. These include 26 species recorded in New Brunswick, 15 in Newfoundland, 31 in Nova Scotia, and 13 on Prince Edward Island (Table 1). *Oligota parva, Acrotona avia, Strigota ambigua,* and *Myrmecopora vaga,* are newly recorded in Canada and *Bledius mandibularis* is newly recorded from Atlantic Canada. Ten new provincial records are reported, one from New Brunswick, six from Nova Scotia, and three from Prince Edward Island. They include representatives of eight subfamilies and 21 genera.

Excluded species

Delimiting the composition of coastal staphylinid communities is much more complicated than might first appear to be the case (see below). The biology of many staphylinids is poorly or incompletely known making it difficult to ascertain to what degree they may be members of coastal beetle communities. Many species of rove beetles are attracted to decomposing plant or animal material, and some coastal environments have large quantities of such materials. Others, associated with flood debris, or hygrophilous

Table 1. Coastal Staphylinidae in Atlantic Canada

	NB	NS	PE	NL	Category	Habitat Type	Micro-habitat	Regional Distribution in northeastern North America
Omaliinae								
Micralymma marinum (Ström) *	1	1		1	O	RS	RS	MA, ME, NH, QC
Pselaphinae								
Brachygluta abdominalis Aubé	1	1			O	SM	LL	CT, MA, ME, NH, NY
Tachyporinae								
Sepedophilus marshami (Stephens) †	1	1			I	SE	TD	QC
Aleocharinae								
Aleochara litoralis (Mäklin)	1	1		1	O	SS	TD	MA, NY, ON, RI
Oligota parva Kraatz			1		T	SS	TD	
Acrotona avia (Casey)		1			O?	SS	DS	RI
Mocyta fungi (Gravenhorst) †	1	1	1	1	I	SE	TD	MA, ME, NY, ON, QC, RI
Strigota ambigua (Erichson)		1	1		F	SS	TD	CT, NY
Atheta novaescotiae Klimaszewski & Majka	1	1		1	O	SS	TD	PM
Atheta acadiensis Klimaszewski & Majka	1	1	1		O	SS	TD	QC
Atheta vestita (Gravenhorst) †?	1	1			O	SE	TD	
Falagria dissecta Erichson	1	1			T	SE	TD	CT, MA, ME, NH, NY, ON, QC, RI, VT
Myrmecopora vaga (LeConte)		1			O	SS	TD	
Oxytelinae								
Bledius basalis LeConte	1	1			F	M	B	NY, RI
Bledius mandibularis Erichson		1			F	M	B	CT, MA, NY, RI
Bledius neglectus Casey	1	1		1	O	M	B	MA, ME, NY, PM, RI
Bledius opaculus LeConte		1	1	1	O	M	B	MA
Bledius politus Erichson	1				F	SM	B	NY
Steninae								
Stenus erythropus Melsheimer	1	1	1		I	SE	DS	MA, ON, QC

	NB	NS	PE	NL	Category	Habitat Type	Micro-habitat	Regional Distribution in northeastern North America
Paederinae								
Ochthephilum fracticorne (Paykull) †?	1	1			I	SS	TD	MA, ME, NH, ON, QC
Staphylininae								
Gyrohypnus angustatus Stephens †		1			T	SE	TD	NH, NY
Xantholinus linearis (Olivier) †	1	1	1		I	SE	TD	MA, NH, NY, RI
Creophilus maxillosus villosus (Gravenhorst)	1	1	1	1	F	SE	TD	CT, MA, ME, NH, ON, QC, RI, VT
Tasgius ater (Gravenhorst) †	1	1	1	1	F	SE	O	CT, MA, ME, NH, NY, ON, QC, RI
Cafius bistriatus (Erichson)	1	1		1	O	SS	TD	MA, NY
Gabrius astutoides (A. Strand) †	1	1			F	SE	?	NH, ON, QC
Philonthus carbonarius (Gravenhorst) †	1	1	1	1	T	SS	TD	MA, NH, ON, QC
Philonthus cognatus Stephens †	1	1	1	1	I	SM	TD	CT, MA, ME, NH, NY, ON, QC, RI
Philonthus couleensis Hatch	1	1		1	T	SE	?	MA, NY, ON, QC
Philonthus furvus Nordman	1	1		1	T	SE	TD	ON, QC
Philonthus politus (Linnaeus) †	1	1		1	I	SE	TD	CT, MA, ME, NH, NY, ON, QC, RI, VT
Philonthus umbratilis (Gravenhorst) †	1	1	1		I	SE	TD	MA, ME, NH, NY, ON, QC
Philonthus varians (Paykull) †	1	1	1	1	I	SS	TD	CT, MA, ME, NH, NY, ON, QC, VT
Total	26	31	13	15				

Notes: O, Obligate (Halobiont); F, Facultative (Halophile); T, Tolerant (Haloxene); I, Incidental. NB, New Brunswick; NS, Nova Scotia; PE, Prince Edward Island; NL, Newfoundland and Labrador. *, Holarctic species; †, adventive Palearctic species.

Habitat: M, mud/sand flats; RS, Rocky Shore; SE, Seashore; SM, Salt Marsh, SS, Sandy Shore. Microhabitat: B, Burrows in sand/mud; DS, Dune Slacks; LL, Leaf Litter; O, Other; RS, Rock Surfaces; TD, Tidal Debris.

For the purposes of this treatment, northeastern North America is considered to include (in addition to Atlantic Canadian provinces of NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; PE, Prince Edward Island) of the following jurisdictions: Connecticut (CT), Massachusetts (MA), Maine (ME), New Hampshire (NH), New York (NY), Ontario (ON), Québec (QC), Saint-Pierre et Miquelon (PM), Rhode Island (RI), and Vermont (VT). Only jurisdictions in northeastern North America in addition to the Atlantic Canadian Provinces are listed.

species found in marshes, are not infrequently found in coastal environments, particularly where these grade into inland habitats. Where inland habitats abut directly onto coastal environments, characteristic forest, marsh, bog or species associated with other environments can spill into coastal habitats. Davies (1979) recorded species such as *Anotylus rugosus* (Fabricius, 1775), *Erichsonius nanus* (Horn, 1884), *Gabrius picipennis* (Mäklin, 1852), *Ontholestes cingulatus* (Gravenhorst, 1802), *Tachinus fumipennis* (Say, 1832), and *Tachinus luridus* Erichson, 1840 from seaweed beach wrack in St. Andrews, New Brunswick. Majka and Klimaszewski (2008) reported *Leptacinus intermedius* Donisthorpe, 1936 from beach debris on Prince Edward Island. In the present study specimens of *Phyllodrepa humerosa* (Fauvel, 1878), *Proteinus pseudothomasi* Klimaszewski, 2005, *Tachyporus dispar* (Paykull, 1789), *Tachyporus inornatus* Campbell, 1979, *Tachyporus mexicanus* Sharp, 1883, *Oxytelus laqueatus* (Marsham, 1802), *Lithocharis thoracica* (Casey, 1905), *Paederus littorarius* Gravenhorst, 1806, *Neohypnus hamatus* (Say, 1834), and *Philonthus lomatus* Erichson, 1840 collected in coastal habitats were examined. All these rove beetles are associated with decompositional situations in a variety of inland habitats. They are not species that have been noted in the literature in association with coastal habitats, although, under appropriate circumstances they will evidently venture into such environments.

In Great Britain, Hammond (2000) drew attention to species such as *Amischa analis* (Gravenhorst, 1802), *Atheta longicornis* (Gravenhorst, 1802), *Quedius curtipennis* Bernhauer, 1908, *Quedius molochinus* (Gravenhorst, 1806), and *Bisnius cephalotes* (Gravenhorst, 1802) as incidental species found in salt-marshes and other intertidal habitats. Similarly Moore and Legner (1976) reported *Drusilla canaliculata* (Fabricius, 1787) from under decaying seaweed in Great Britain, Newton et al. (2000) reported *Tasgius melanarius* (Heer, 1839) from under debris near water, including in marine situations, and Smetana (1995) reported *Philonthus concinnus* (Gravenhorst, 1802) from a variety of habitats including under seaweed on sea beaches. All these Palearctic species are found in Atlantic Canada (Majka and Klimaszewski 2008), however, none of them have been recorded in such habitats in the Atlantic Provinces. They are all species generally associated with soil and litter environments and/or decaying material, and therefore only peripheral members of coastal environments. In this preliminary treatment of the coastal rove beetles of Atlantic Canada they have therefore not been included in the coastal fauna, although it is clear that further research is required to fully delineate the faunal composition of coastline environments.

Adaptations to the marine environment

Staphylinids found in coastal environments can be categorized in four functional groups (adapted from Koch 1989-1993 and Hammond 2000):

A) Halobionts: Obligate inhabitants of coastline environments, i.e., species that are largely or completely restricted to such habitats;

B) Halophiles: Facultative inhabitants of coastline environments, i.e., those that regularly occur in coastline habitats but can also be found in non-marine situations;
C) Haloxenes (or halotolerants): species that principally occur in other inland environments, but are also found in coastline habitats and are (in varying degrees) tolerant of conditions in such habitats;
D) Incidentals: species that exhibit no specific coastal associations, but are attracted to decomposing situations or marshy or otherwise wet environments, and which are thus regularly found in coastal environments where such conditions exist.

The delineation between these categories is not without some uncertainty since, as previously mentioned, the bionomics of some species are incompletely known. Based on published information and data from specimens collected in the region a provisional categorization indicates that 11 species found in Atlantic Canada can be categorized as halobionts, seven as halophiles, six as haloxenes, and nine as incidental species.

As previously mentioned, there is no simple delineation between coastal and non-coastal species, given the fact that terrestrial ecosystems grade into marine ecosystems along a continuum (indeed, coastline environments are by definition an ecotone) and contain microhabitats that attract and support terrestrial species. In delimiting the fauna, however, studies such as these by Topp and Ring (1988a,b) are of considerable value. In examining the ecology and physiology of Pacific-coast marine Staphylinidae found on sandy and rocky shorelines, they were able to demonstrate a suite of specific morphological, behavioral, and physiological adaptations to immersion by seawater and desiccation that allowed the marine species to survive in such environments. These include sheltering in burrows or crevices which hold air pockets during inundation (*Bledius* spp., *Liparocephalus cordicollis, Diulota densissima*); taking flight when inundated by seawater (*Bledius monstratus*), holding a bubble of air around the thorax and abdomen with a plastron on fine hairs on the body surface (*B. monstratus*) which acts as a "physical gill" to supply air to the spiracles; floating on the surface film of water when inundated (*Thinopinus pictus*); becoming catatonic in conditions of anoxia, thus slowing physiological processes allowing for longer survival in conditions of immersion (*Cafius canescens, Cafius seminitens, Hadrotes crassus*); and utilizing dissolved oxygen through cutaneous respiration through membraneous portions of the exoskeleton (*L. cordicollis*). Such morphological, behavioral, and physiological adaptations contrast with those of terrestrial species and are reflected in the LT_{50} (median lethal time) values for seawater immersion of such species. At 10°C, LT_{50} values were 12-16 hours for *C. canescens*, 12 hours for *T. pictus*, and 18 hours for *B. monstratus* while rocky-shore species such as *D. densissima* had LT_{50} values of 26 ± 4 days and *L. cordicollis* 25.5 ± 9.5 days. This is in contrast to species such as *T. ater*, which had an LT_{50} value of 2 hours (Topp and Ring 1988a, 1988b). Such research indicates that detailed morphological, behavioral, and physiological studies of coastline inhabiting beetles could be used to distinguish between obligate, facultative, tolerant, and incidental species.

Coastal environments and their staphylinid faunas

Coastal environments are themselves diverse and include a number of discrete habitats and zones. In the Maritime Provinces they include: i) rocky shores, ii) boulder/cobble shores, iii) sandy shores, iv) mud flats, v) tidal marshes, and vi) sand dune systems (Davis and Browne 1996). Some of these environments (such as rocky, boulder, and sandy shores) are further stratified into i) splash zone, ii) upper littoral, iii) mid-littoral, and iv) lower littoral zones; mudflats and tidal marshes sometimes grade into successional sequences and differentiate into high and low salt-marsh areas; and sand dunes are differentiated into i) colonizing zone, ii) yellow dune, and iii) grey dune areas (Davis and Browne 1996). Further variation is created by the intersection of these coastal habitats and the presence of microhabitats (such as brackish-water "slacks" between dune crests). Consequently coastal environments represent a diverse constellation of habitats and microhabitats that can provide for a large number of ecological niches that can be utilized by coastal beetles.

This diversity is reflected in the coastal staphylinid fauna found in Atlantic Canada. *Micralymma marinum* is a true marine species found in the littoral zone on rocky coastlines. Species of *Bledius* inhabit sandy mudflat environments. Large rove beetles such as *C. m. villosus* and *Tasgius* spp. tend to shelter under stones or driftwood in the splash zone or upper littoral areas from where they venture into strand-line areas. *Philonthus* spp. and many aleocharines are primarily found associated with decaying seaweed and other organic materials deposited by tidal action at the upper end of the littoral zone. *Brachygluta abdominalis* is found in leaf litter in salt marsh and sand dune areas, and *Stenus erythropus* inhabits wet, marshy habitats.

An admittedly first-order summary of the habitat types and microhabitats within each of these, that are favoured by the coastal staphylinids found in Atlantic Canada, is presented in Table 1. These categories are derived from those employed by Hammond (2000) in his analysis of the British coastal fauna. In the case of some species such as *M. marinum, B. abdominalis, A. litoralis, A. novascaotiae, A. acadiensis, A. vestita, Bledius* spp., *C. maxillosus, T. ater,* and *C. bistriatus,* there has been sufficient research conducted that at least some elements of the bionomics of these species are comparatively well known. In the case of others such as *O. parva, A. avia, S. ambigua, M. vaga,* and *S. erythropus*, very little is known of the biology of the species so the information in Table 1 is of necessity based on limited data. Nonetheless the compilation is instructive since it illustrates that the coastal staphylinids appear to fall into five ecological groups:

1) rocky shore species (*M. marinus*)
2) salt marsh, leaf-litter species (*B. abdominalis*)
3) species found around dune slacks (*A. avia, S. erythropus*)
4) sand/mud-flat inhabitants (*Bledius* spp.)
5) tidal debris (beach-drift) species (other species)

Amongst the tidal debris species, some appear to favour sandy shores or salt marshes, while others (the "SE" seashore category) are found on sandy, rocky, or cobble shores wherever beach-drift accumulates.

From a trophic perspective, *Bledius* spp. are nocturnal feeders and harvest green algae such as *Oocystis solitaria* Wittr., *Oocystis parva* West., *Anchistrodesmus falcatus* Ralfs, and *Conferva minor* Klebs), blue-green algae such as *Oscilitoria amphibia* Ag. and *Anabaena* sp., and diatoms (species undetermined) from the mud or sand surface, storing them in chambers excavated in the mud where the females lay eggs and rear young (Lengerken 1929; Herman 1986). Other species of coastline staphylinids are (insofar as is known) primarily predaceous, however, the size of the species and the habitats they occupy mean that they utilize a variety of prey species. Most coastal staphylinids feed on amphipods, larvae of seaweed flies such as *Fucellia* sp., or enchytraeid worms such as *Lumbricillius* sp. and *Enchytraeus* (Moore and Legner 1976; Top and Ring 1988a, 1988b). Large Staphylininae such as *C. maxillosus, Tasgius* spp., and *Philonthus* spp. are generalist predators (Smetana 1995; Newton et al. 2000) that in beach drift habitats probably feed on Diptera larvae as well as on other invertebrates. *Aleochara litoralis* is also a predator of larvae and eggs of cyclorrhaphous Diptera (Klimaszewski 1984). *Cafius bistriatus* is predaceous on amphipods, fly larvae, and small barnacles (James et al. 1971). *Micralymma marinum* and species of *Stenus*, such as *S. erythropus,* prey on Collembola and other micro-arthropods (Thayer 1985; Böcher 1988; Newton et al. 2000). *Brachygluta abdominalis* and *Oligota* species are predators of mites (Acari) (Frank et al. 1992; Hammond 2000). While the bionomics of other species of coastline aleocharines are incompletely known, most are believed to be microfauna predators.

Adventive species

The substantial proportion of adventive Palearctic species represented in this ecological group is noteworthy. As many as 13 species (the zoogeographic status of *O. fracticorne* and *A. vestita* are still subject to some questions), or 39% of the coastal species, are adventive species. These are principally the members of the Staphylininae, indeed of the 13 species in this subfamily, only *C. bistriatus, P. couleensis,* and *P. furvus* are native North American species.

Brown (1940, 1950) and Lindroth (1957) both proposed that many species of adventive plants and invertebrates were introduced to Atlantic Canada in dry ballast that was shipped to the region during the Napoleonic wars and subsequently when Great Britain was importing large quantities of timber from the region. Empty ships traveling westward across the Atlantic were ballasted with sand, rocks, rubble, soil, etc., originating from coastal quarries. This dry ballast was subsequently off-loaded on land in Atlantic Canadian ports, and with it a plethora of species that were found in such coastal sites. Of the 13 adventive coastal staphylinids found in Atlantic Canada, eight (*M. fungi, A. vestita, G. angustatus, T. ater, G. astutoides, P. carbonarius, P. cognatus,* and *P. varians*) were found by Lindroth (1957) in quarries in south-western England where

dry-ballast destined for Atlantic Canada originated, a suggestive indication that these species may have been introduced to the region via this mechanism. Indeed, all 13 adventive species of staphylinids are found in Great Britain.

Conservation concerns

Coastline beetles inhabit an environment that has been much diminished and is vulnerable to disturbance. Of the estimated 35,700 hectares of coastal marshes present in the Bay of Fundy at the time of European colonization, only 5,000-6,000 (~ 16%) are still extant. Fifty-seven percent of large and medium-sized rivers that flow into the Bay of Fundy have dams, causeways, and other forms of tidal restrictions and coastal wetlands have experienced various other forms of environmental degradation (Percy 1996, 1999). Rantwell (1972) emphasized that coastal sand dunes are a diminishing resource throughout Europe and North America saying, "Not only is their generation limited by what is believed to be a diminishing bank of offshore sand supplies, but their rate of destruction under development of various kinds ... almost certainly (exceeds) their rate of formation". Tyrrell (2005) pointed out that on some beaches, large quantities of seaweed and other detritus are removed from the wrack line to "clean up" beaches for recreation or tourism. Orth et al. (1978) and Frank et al. (1986) have both noted the negative effects of such "beach cleaning" on seashore insect assemblages. All these observations draw attention to the potential vulnerability of such coastal habitats and communities of beetles that inhabit them.

With the discovery of *Oligota parva, Acrotona avia, Strigota ambigua, Myrmecopora vaga,* and *Bledius mandibularis* in Nova Scotia (four of which are newly recorded in Canada) it is apparent that there is much more to learne with respect to the Staphylinidae that inhabit coastline environments in Atlantic Canada.

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